TEXTILE RESEARCH

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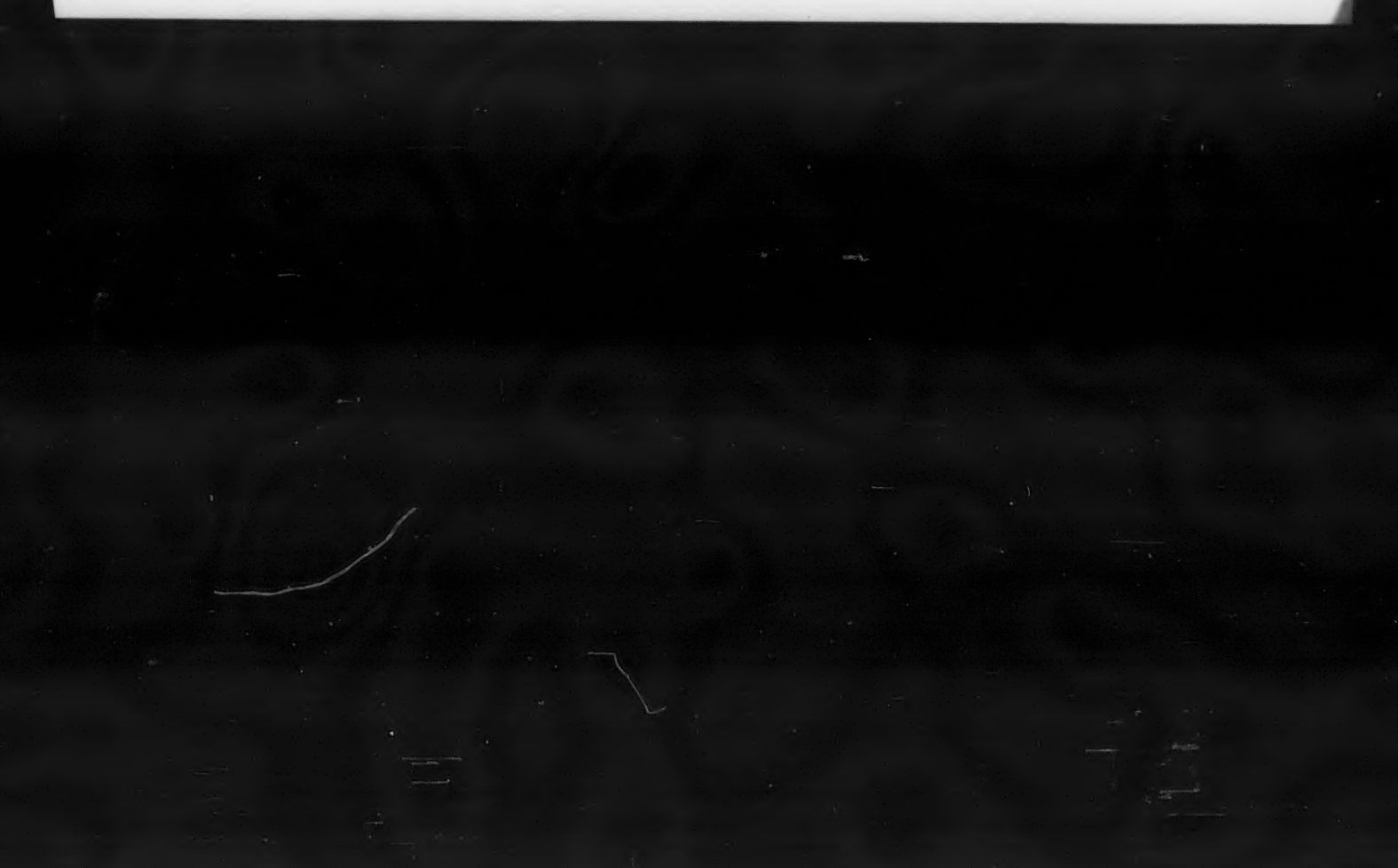


VOL. XIII **TEXTILE RESEARCH** NO. 14

Outstanding Features in

This Month's Issue

Annual Meeting

Report of members' meeting of Textile Research Institute, Inc., and report of president. (See pages 2 and 4.)

Fundamental Research

What the textile industry can expect from fundamental research was outlined in a stirring address by Dr. Hugh S. Taylor at the Institute's annual meeting. (See page 8.)

Applied Research Program

Giles E. Hopkins outlines the scope of the Institute's applied research program (see page 12); Malcolm E. Campbell describes the Institute's intensive study of cotton carding (see page 14); and the proposed survey of wool manufacturing methods is discussed. (See page 19.)

Functional Properties of Clothing Fabrics

Factors influencing the comfort and protection against the elements required of clothing fabrics. (See page 21.)

A Better Day. By Douglas G. Woolf

There is a clean-cut choice between adherence to status quo and adjustment to an uncharted post-war world. The key to the latter lies in fact finding. (See page 28.)

Vertical or Horizontal Organization?

Shall the post-war organization of textile companies be vertical or horizontal? (See page 30.)

New Tempo in Textile Research Is Dramatized at Annual Meeting of

Textile Research Institute, Inc.

THE NEW TEMPO IN TEXTILE RESEARCH was never more clearly dramatized than at the 14th annual meeting of the Textile Research Institute, Inc., held Nov. 18 at Hotel Roosevelt, New York. It presented an action photograph of research on the march in this industry which in the past has been criticized for its lack of interest in this field.

The forward movement toward sure accomplishment was reflected in the technical session in the morning, devoted to the applied research projects of the Institute; in the report of the president, Fessenden S. Blanchard, and reports of standing committees, at the business session preceding the luncheon; in the stirring address of Dr. Hugh S. Taylor, Princeton University, principal speaker at the luncheon; and in the afternoon session devoted to a summarization of the post-war implications of the research which has been conducted on fabrics for military uses.

The morning technical session was conducted by Giles E. Hopkins, director of applied research, and the speakers included Malcolm E. Campbell, dean of the Textile School at North Carolina State College, Lt. Col. Frank M. Steadman, of Philadelphia Quartermaster Depot, Rinaldo Lukens, of Continental Mills, A. G. Ashcroft, of Alexander Smith & Sons Carpet Co. and Werner von Bergen, of Forstmann Woolen Co. The afternoon session was conducted by Dr. Milton Harris, director of fundamental research for both the Institute and the Textile Foundation; speakers included Dr. H. F. Schiefer, of the Bureau of Standards, and Dr. Lyman Fourt and Arnold M. Sookne, both of the staff of the Textile Foundation.

At the business session Fessenden S. Blanchard was re-elected president and executive secretary. Douglas G.

Group at speakers' table, left to right: Hugh S. Taylor, chairman of the department of chemistry, Princeton University; Fessenden S. Blanchard, president, Textile Research Institute, Inc.; Franklin W. Hobbs, chairman, board of directors, Textile Foundation.

Woolf, who recently joined the staff of the Institute as director of information and economic research, was elected first vice-president. Dr. Robert E. Rose and Dr. Harold DeWitt Smith were re-elected as vice-presidents, and Edward T. Pickard was re-elected treasurer. Robert R. West was elected a director of the Institute. The other directors were re-elected.

Committee reports presented at the business session included those presented by W. D. Appel, chairman of the applied research committee; Robert R. West, chairman of the economic research committee; and Douglas G. Woolf, chairman of the publications committee.

The directors of the Textile Research Institute, Inc., include: W. D. Appel, John Bancroft, Jr., Arthur Besse, Fessenden S. Blanchard, F. Bonnet, C. F. Broughton, Fuller E. Callaway, Jr., H. M. Chase, Earl Constantine, Alban Eavenson, Russell T. Fisher, Ephraim Freedman, H. Grandage, M. Earl Heard, Marland C. Hobbs, Charles J. Huber, J. Spencer Love, W. M. McLaurine, Louis A. Olney, Edward T. Pickard, D. H. Powers, Robert E. Rose, Edward R. Schwarz, Albert L. Scott, Harold DeWitt Smith, Charles A. Sweet, A. M. Tenney, Albert C. Walker, Robert R. West, and Douglas G. Woolf.

Mimeographed copies of the President's address and of the committee reports will be sent to members on request.

Immediate Expansion and Plans for Future Mark Epochal Year in

Textile Research Institute

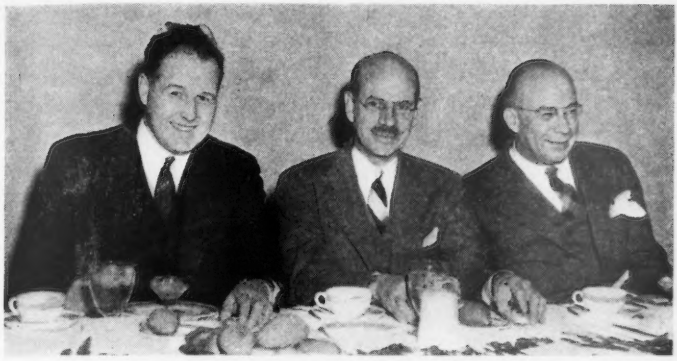
By FESSENDEN S. BLANCHARD*

DURING THE LAST YEAR we have had two major purposes constantly in mind: (1) to extend our present facilities and set-up, increase our membership and other sources of income sufficiently to build the nucleus of our future organization, and to start work on several research projects where outside facilities could be found; (2) to plan our Textile Research Institute of the future, decide what kind of an organization we want and where it should be located and organize the raising of the necessary research funds to carry out our purposes.

One of the most important developments of the past year has been our success in obtaining the three key men for our future organization. Doug Woolf, as he is known to many of you, showed his faith in our future in the best way a man can show that faith, by leaving a 27-years' association in another job and the important position of editor-in-chief of *Textile World*, and casting in his lot with us in a position which he feels, as we also feel, offers an even greater opportunity for service to the industry. As you all know, Doug has become director of information and economic research for the Institute.

The second key man who has recently joined our organization is Giles E. Hopkins, who has become director of applied research. When Malcolm E. Campbell left us to accept the important position of dean of the Textile School at North Carolina State College, I asked the advice of our technical research committee regarding a new man.

* President of Textile Research Institute, Inc.; abstract of his report at annual meeting Nov. 18, 1943.



At speakers' table, Institute luncheon, left to right: Robert R. West, president, Esmond Mills Inc., and chairman of economic research committee, Textile Research Institute, Inc.; Douglas G. Woolf, vice-president and director of information, Textile Research Institute, Inc.; Claudius T. Murchison, president, Cotton Textile Institute.

When the possibility of getting Giles Hopkins came up, a number of members who knew him told me at once that we'd be lucky if we could get him. Well, he's here, as those of you who attended this morning's meeting have seen.

Dr. Milton Harris has accepted the other important key position, as director of fundamental research of the Institute. He will continue as director of research of the Textile Foundation. This is further evidence of the splendid cooperation between the Foundation and the Institute, and it promises a direct and united approach to our mutual objectives—the advancement of textile research.

Further, I am also glad to announce that the following men, members of the Foundation's advisory committee for scientific research have consented to serve as members of the Institute's advisory committee for fundamental research: Dr. Robert E. Rose, Warren E. Emley, Alban Eavenson, Dr. R. Y. Winters, Dr. Hugh S. Taylor, and Dr. Harold DeWitt Smith.

During the last year a number of supplements and information reports have gone out, including ones on mildew-proofing of military fabrics, water-repellency, fireproofing, bibliography of nylon, handling of high density cotton, etc. Hundreds of requests for copies of these re-

ports have come in.

Another important development of the past year has been the set-up of a new and strong committee on economic research under the chairmanship of Robert West, President of Esmond Mills. You have heard the report of this Committee. Mr. Woolf will work very closely with it and have supervision of any project that may be developed.

We shall shortly bring out one economic research report on which I shall have to plead guilty of spending many nights and Sundays bringing up to date my earlier experience in China and Japan. This is on "The Textile Industries of China and Japan—Problems and Opportunities for America." The future of these industries is more important to our textile industry than many of us realize.

Plans for the Future

I'd like now to report progress on our plans for the future. During the last year I have visited and studied a number of research organizations, textile and otherwise, and discussed research with many mills. As a result of much study we came to the following conclusions as to our future Textile Research Institute.

1. That the Institute should cover all branches of the textile industry, and all fibers.

2. That the Institute should locate its laboratories near but not in New York—for New York is an important center of scientific activity, where research men and executives frequently gather, convenient to all branches of the textile industry, yet an environment just outside of New York is considered more favorable for uninterrupted research.

3. That the Institute should have a five-point program covering:

(1) Fundamental research.

(2) Applied research and mill contacts.

(3) A graduate school in affiliation with a leading university.

(4) Economic research.

(5) Information service, publications, abstracts, library, etc.

4. That a research fund of $300,000 a year for five years, or $1,500,000 plus a capital fund of $500,000 should be solicited from all major branches of the industry.

Albert L. Scott, president of Lockwood Greene Engineers, Inc., and one of our directors, has been unanimously requested by the directors to act as general chairman of a research fund committee and is generously giving a good deal of his time in helping the officers of the Institute to line up leaders interested in research in each major branch of the industry, who will help us in raising our research fund.

The Textile Research Institute and Textile Foundation, who are working in effect as partners, cover all branches of the textile industry and all fibers. In addition to our fundamental, applied and economic research programs, we hope to serve as a coordinating agency, as a clearing house for textile research; to assist other groups in avoiding unnecessary duplication and thus help to point up textile research to its main objective.

We are on our way. It is our belief that all branches of the textile industry will show the breadth, wisdom, and foresight to join in a united effort through research to meet the serious competition that lies ahead of us in the postwar world: competition from other countries with lower labor standards; competition with other industries in the United States to meet consumer and industrial needs; competition for a larger share of the consumer dollar; competition within our own industry to hold leadership in the creative development of textiles. The sooner this great industry of ours realizes that the barriers between the various branches are breaking down—whether it is barriers of fiber or of equipment—the sooner we shall be able to cope with the problems which will follow the war. Isolationism is insufficient for defense, an inadequate basis for aggressive attack, in the textile industry as well as in world affairs. We are first of all —not cotton men, woolen men, or rayon men—but textile men. In the long run we'll win out only if we use those fibers and that equipment best suited to the purpose required. It will be the job of the Textile Research Institute to help all of its members to this end.

Noted Scientist Tells Textile Industry What It Can Expect from

Fundamental Research

WHAT THE TEXTILE INDUSTRY CAN EXPECT from fundamental research, was the subject of an address by Dr. Hugh S. Taylor of Princeton University, guest speaker at the luncheon held in connection with the annual meeting of Textile Research Institute, Inc., Nov. 18th.

As illustrative of the importance of broad fundamental or basic research programs, Dr. Taylor cited what he called "The Parable of T.N.T." In spite of the millions of dollars spent during World War I in an effort to produce toluene from petroleum source materials, very little toluene was so produced. It was not until about the year 1935 that the successful solution of the problem was arrived at and by three individual groups of workers, one in Moscow, one in Chicago, and one in Princeton, each unknown to the others. In the case of the Princeton group the speaker stated that the finding was not conditioned by a search for that particular objective. At Princeton there was being carried out a fundamental investigation into the mechanism of chemical reactions, the properties of hydrocarbons generally, and the influence of catalytic surfaces on those hydrocarbons. The production of toluene from heptane was a mere by-product of that basic research program.

"Since 1914 there has been a great growth of basic science in this country and in Russia especially," said the speaker, "and we established a nation-wide confidence in the power of science in every branch of American industry. In fact every basic producer came to the turn in the lane where all signposts of progress pointed in one direction: to the research laboratory. It did not get there all at once, but most of us got there before German hob-

At speakers' table, Textile Research Institute luncheon, left to right: Harold DeWitt Smith, A. M. Tenney Associates; Milton Harris, director of fundamental research, and Giles E. Hopkins, director of applied research, Textile Research Institute, Inc.

nailed boots were pounding over the streets of Warsaw.

"We in the universities have been very much concerned with the growth of educational supply to meet the research demand. There has grown up, in and out of the universities, centers of research devoted to a group of interrelated or interconnected problems. These laboratories have been classified by Dr. Mees of the Eastman Kodak Laboratories as 'convergent laboratories,' where problems of many kinds but all interrelated can be studied. These laboratories may well be described as 'research institutes' and these Dr. Mees expects to be the most important of the agencies for the production of fundamental science in the future.

Research Institutes

"In this country monetary grants in support of promising research are producing research institutes convergent rather than divergent in nature within the framework of existing universities or as separate organizations with some degree of affiliation with colleges or universities. Examples that may be cited are: the Institute of Paper Chemistry, the Institute of Gas Technology, and the Petroleum Institute." Dr. Taylor spoke of the research programs that have been sponsored by the Textile Foundation and said—"it is from this research work of the Textile Foundation that, if the textile industry is worthy of its obligation, there may spring an essential institute for fundamental research in textiles,

affiliated with some educational institution."

Among the benefits accruing to industry from fundamental research was mentioned the important fact that the supply of adequately trained research workers inevitably increases in centers of intense research activity, also that the broadening of understanding which accompanies each new discovery means for the industrial research laboratory a surer, swifter, and more economical approach to its own particular specialized objectives.

For the decentralized industries operating in small, widely scattered units not capable of maintaining fundamental research laboratories, it was stated that "the solution of their problems seems to lie in cooperative effort through the development of the research institute whose main objectives should be: first, the prosecution of fundamental studies in the general field of the pertinent subject, its physics, its chemistry, its biological and engineering aspects; it should lie, secondly, in the dissemination of research information; and, thirdly, the training in the methods of research of specially selected personnel at the graduate student level for future positions of responsibility within the industry."

Contribution to the Textile Industry

Dr. Taylor mentioned a few of the scientists whose outstanding work has laid the foundation on which new programs of technical science are actually at this moment moving swiftly forward. He alluded to the fact that in his student days no one was particularly interested in the architecture of the molecule but students were told they were simply hard, spherical, billiard-like balls that collided with one another and occasionally entered into reaction. Actually it was discovered that molecules could be long and skinny. This was a fundamental contribution to the textile industry for it taught that nature had devised a way of linking atoms to atoms in such a way that they could produce filamentary threads rather than round balls.

Now the chemist has learned how to produce a long filamentary chain of molecules. He can even break up the flat ring structure of the benzine molecule, take it apart and get it into a long chain material. "There is

At speakers' table, Institute luncheon, left to right: Willis S. MacLeod, special assistant to vice-chairman, Office of Civilian Requirements, W.P.B.; Edward T. Pickard, assistant treasurer, Textile Foundation and treasurer, Textile Research Institute, Inc.; Lt. Col. Stephen J. Kennedy, Textile Section, Research and Development Branch, Office of the Quartermaster General.

one very striking illustration of the results that may accrue to the textile industry arising out of the basic program of fundamental research which has been sponsored by the Textile Foundation at the Bureau of Standards over a period of years under my good friend Milton Harris. It has been known that the point of attack by the moth upon the wool fiber is the sulfur bond in the molecular chains which join the long parallel chains of the wool structure. By splitting the sulfur atoms apart and putting a carbon atom in between, Milton Harris has been able to render wool moth proof."

The development of the nylon structure was also cited as an example of what is possible, because the chemist realized what his objective was (and he realized that objective because of the basic science with which he had preceeded his attack) he was able in the person of Carothers, to proceed swiftly to the objective he desired.

"My time is up, but I hope I have convinced you that there lies before the Textile Research Institute of the United States a real opportunity in the sponsoring of basic fundamental scientific research and, in so doing, they may expect that having so done they will themselves reap the reward of those efforts."

Giles E. Hopkins Outlines Scope of the Institute's

Applied Research Program

By GILES E. HOPKINS*

THE APPLIED RESEARCH PROGRAM is related to that of fundamental research much as engineering is related to science. Although our fundamental program is uncovering basic principles pertaining to textiles, the applied program must indicate how these principles may be put to work, to pay dividends. We cannot hope to carry this application into the detailed ramifications for local conditions in each mill but we should develop the principles to a point where competent mill technical staffs can "pick up the ball."

The interpretive function will not be one way. The Director hopes to visit the technical staffs of each of our members to learn their problems and from these to select common denominators, of value to sections of the industry, and requiring more comprehensive study than may be afforded by individual laboratories.

The contacts will include all laboratories working in the textile field. In addition the work of the engineering laboratories, the equipment manufacturers, the chemical industry and the electrical researches will be closely followed. We can no longer identify any one set of technical facilities and consider we have included the probable sources of developments of concern to the textile industry. The revolutionary steps that may serve either to insure the prosperous continuation of the industry, or to transfer its markets to other suppliers may come from the aerodynamic principles now used in plane design, electronics now employed in control devices, or supersonics the possibilities of which have not been explored.

We must know these trends and bend them to our

* Director, applied research, Textile Research Institute Inc. Abstract of Mr. Hopkins' opening remarks at annual meeting.

Group at speakers' table, Institute luncheon: left to right—Thomas R. Smith, president, American Association of Textile Chemists and Colorists; Robert E. Rose, consultant to technical laboratory, Du Pont Dye Works, and vice president, Textile Research Institute, Inc.; Lt. Col. Frank M. Steadman, Procurement Division, Research and Development Branch, Philadelphia Quartermaster Dept.

purpose, keeping our membership informed so that their individual programs will be so guided, and impressing these now foreign fields with an awareness of textile problems and our receptive attitude and ability to apply the products of their endeavors, so that we will receive the same attention now accorded the communications, transportation, and other industries that now enjoy a proprietary interest in early applications of the newer sciences.

We are not in favor of establishing a large independent laboratory but prefer to have our facilities grow naturally and soundly, providing only those most commonly and frequently needed or those not otherwise economically grouped for our needs.

We will rely strongly on our new applied research committee supplemented by consultants to be called upon according to particular active problems, subcontracting the actual work to existing facilities, textile schools, engineering schools and sometimes our members laboratories.

Our functions are recognition and definition of common problems, determination of the principles involved in their solution, selection and provision of proper facilities for their study, and the interpretation and distribution of the results.

Increased Production with Minimum Damage Is Aim of Textile Research Institute's

Intensive Study of Cotton Carding*

By MALCOLM E. CAMPBELL†

A CONTRACT WAS RECENTLY SIGNED between the Office of Production Research and Development and the Textile Research Institute to conduct some research of practical aid to the war effort. Supplementary arrangements have been made between the Institute and the Textile School of North Carolina State College to carry out the work in the research laboratories of the college. The program was outlined with the help and approval of the Institute's applied research committee. The following discussion covers the need for the research chosen and a description of the work under way.

The program involves intensive study of cotton carding aimed at increasing the production in carding with minimum damage to the quality of the product.

Importance of the Cotton Card

Listing the machines used in converting cotton from the bale to the yarn, it may be seen that between 7 and 18 separate processes are required depending on the product made and the equipment available. Which, if any, machines in the series are indispensable? The comber, blending feeder, roving frames, or even spinning frame, can be eliminated, but up to the present no practical substitute has been developed for the card, although some inventors claim ability to form clean, uniform sliver without carding.

* Digest of paper delivered at applied research meeting held in connection with annual meeting of Textile Research Institute, Inc., November 18, 1943.

† Dean, North Carolina State College Textile School. Presented at the 14th Annual Meeting of the Textile Research Institute, Inc., New York City, November 18, 1943.

It has always been interesting to me to examine the "carding engine," now in the Smithsonian Institution, built by 21-year-old Samuel Slater in 1790. In the main the features of Slater's card are surprisingly similar to those of the present-day machine. It has been said that no basic patents of any importance have been granted with respect to the card since the 1850's. Twenty years ago I saw waste cards that had been in operation for more than 50 years, and they resembled very closely our modern machines except that they were of the roller-and-clearer type.

It is estimated that there are 80,000 cards now used in the country. These are expensive and if radical changes are made in design, there would be tremendous inertia to overcome in their replacement, therefore we can expect the present machine to be with us for many years.

Speeds and settings are governed to surprising extent by tradition. Until recently it was heresy to suggest cylinder speeds in excess of 165 or 170 revolutions per minute. Work of recent investigators, however, has given clear indication that production can be increased without loss of quality by speeding up the card. Some mills claim to have done this, others maintain it is not feasible.

Card Production Now Critical

Cards are now the bottleneck in war-time cotton production, because the balance of mill machinery as arranged for peace-time production is definitely upset when the mills convert to war fabrics such as Army uniform twill requiring coarser yarns. At the same time quality is more important than ever because war fabrics must reach rigid specifications in strength and serviceability. There are shortages in better qualities of cotton, so that the use of inferior raw material presents a distinct challenge in the production of high quality goods at maximum card capacity.

Anything that will help increase card production without quality loss will directly help the war effort. Recent investigations fall short in two respects: (1) little attention has been paid to the differential effects of card speeds upon cottons possessing different fiber properties,

and (2) recent studies have not involved critical determination of what happens to such factors as fiber length distribution, fiber strength, sliver uniformity, nep contents, etc., as card speed is changed.

It has been suggested that production might be increased more efficiently by using heavier laps and slivers than by increasing the speed. Theories are advanced to substantiate this, but facts are lacking. The question of to what extent conditions of carding cause breaking and weakening of fibers is also unanswered. It is reasonable to assume that the situation with strong fibered cotton may not hold true for a weak one or that a fine fiber cotton may react to card speeds and weights of stock in a different way from coarse cotton. Cottons vary considerably in physical characteristics, and sound methods for evaluating their properties are now available. Techniques are also available for measuring the composition of different wastes, the uniformity of carded stock and freedom from neps and other imperfections.

Laboratories at N. C. State College Textile School

We are fortunate in having a complete pilot spinning mill at State College, designed for projects such as this. This well-lighted, humidified laboratory is equipped with a card, small comber, drawing frame, complete series of roving frames, and half a dozen laboratory spinning frames of different types. Adjacent available laboratories house a complete opening and picking unit, additional cards, long draft fly frames and different kinds of spinning frames and twisters. The weave rooms are unusually well equipped for a wide variety of experimental fabrics and dyeing and finishing facilities are available for many types of experimental treatment. Enlargement of our testing laboratory is anticipated to include complete equipment for every type of fiber, yarn and fabric testing and research. The project is under the direct supervision of G. H. Dunlap who was responsible for some of the outstanding earlier work and who was recently added to our staff as technologist. Other staff members are assisting him.

There are two parts to the program. The first series

At speakers' table, Institute luncheon, left to right: John W. Wright, chief, Research and Testing Division, Cotton and Fiber Branch, War Food Administration; and Malcolm E. Campbell, dean of the Textile School, North Carolina State College.

of studies is devoted to individual variables, other variables held constant where feasible. Effects of changes in speed of the entire machine, cylinder, lickerin, doffer and flats will be determined in sequence and the effects of varying front plate settings, weight of lap fed, and draft, will be measured.

The second series will include various combinations of these and other factors affecting production, with the details based on findings of the first series. Four qualities of cotton are used, selected according to fiber specifications, through cooperation of the U. S. Cotton Ginning Laboratory at Stoneville, Miss. These include two bales of Strict Low Middling grade, one-inch staple, with fiber strengths higher than 85,000 lb. and lower than 65,000 lb. per sq. in. "Chandler" respectively, and two bales of the same grade but 1⅛ inches in staple and with Chandler strengths above 82,000 lb. and below 68,000 lb.

Method of Study

In illustration of the method of study an outline is given of the case in which the lickerin speed is varied. Five laps from each cotton are carded, each with a different lickerin speed, ranging from 325 to 725 revolutions per minute. A constant cylinder speed of 165 RPM is maintained throughout this group of tests. Lap and sliver weights are also held constant, so the production

in pounds per hour is not varied. As the carding of a particular lap is completed, the total quantity of each type of waste is recovered and weighed, including motes and fly, flat strips, cylinder and doffer strips, and sweepings. Each sample of waste will then be passed through a Shirley Analyzer, to show the proportion of fiber in the waste. During carding, at a specified time after the start, specimens of web are taken on velvet-covered boards, and the number of neps per board is determined with the aid of a reading glass. The results of several boards are averaged, and this value is a reliable index of the efficiency of the machine at that particular lickerin speed, as far as neppiness is concerned.

In the fiber laboratory, arrays are made of samples of the lap and sliver, to determine the degree of fiber breakage at the different lickerin speeds. A similar analysis is made of the fibers in the flat strips and lickerin fly. Pressley strength tests of the lap and sliver show whether the fibers are weakened to a greater extent with higher lickerin speeds.

After carding, the product of each lap is carried through the pilot plant and spun into yarn. This is tested for size, strength by both skein and single strand methods, and appearance. Also, a quantity of each yarn is made into a knitted fabric, to give an overall picture of its cleanliness, freedom from neps, and general uniformity.

Several yards of sliver are drawn from each lot, to be tested for uniformity with an automatic sliver tester. This information will be particularly useful in showing whether the uniformity of the product is influenced by the speeds of the different parts of the machine.

In the group of tests involving the speed of the whole card and of the cylinder alone, power tests are made under actual operating conditions including power to bring the machine to operating speed, and energy for continuing operation. These factors are important where a large increase in power would be impractical with the motors at hand.

This description of one phase of the study should give a clear idea of what is involved in the whole study.

Survey on Wool Manufacturing Methods Is First Step in Institute's

Wool Program*

THIS PROJECT IS ONE OF MANY which have been suggested as contributing to the war effort. A recent Quartermaster Corps survey of methods of manufacture of serge pointed to means of eliminating some of the inconsistencies of cost, capacities and quality of the fabric as made to the same specifications in different mills. In some cases low capacities associated with abnormal manufacturing methods were found in mills requesting additional critical equipment through WPB. Proper adjustment in the light of information disclosed in the survey might eliminate the necessity for this use of critical material and the expenditure of capital for its purchase.

The woolen practices are subject to still greater variations. These are reflected in quality differences, no doubt magnified in undue variations in performance.

The suggested wool program is considerably more extensive and comprehensive than the serge program. It will include four steps: (1) a survey of the present manufacturing methods, including mills transferring to war fabrics from widely different materials. It will also be geographically representative; (2) a correlation between methods of manufacture and laboratory tests on the raw stock, stock in process and finished product; (3) a verification of demonstrated trends, eliminating the influence of preliminary processes in comparing the effects of suspected process variations on laboratory results; (4) interpretation of these results from a balanced consideration of costs, capacities, and quality.

The plan as outlined was discussed by several interested and competent individuals as follows.

Lt. Col. Frank M. Steadman, Philadelphia Depot,

* Abstract of discussion at applied research session at annual meeting of the Institute.

Q. M. C. stated that the full benefits of the serge study will not be realized until performance data are available. It was obviously of value and there is no question but that a similar study on wool would be of still greater value. The Q. M. C. research department is anxious to cooperate in this study.

Rinaldo A. Lukens, vice-president, Continental Mills, Inc.—"It seems evident that the survey of methods of manufacturing 32 oz. melton and Army blankets should be of immediate value. . . . Besides being of value to mills now making war goods the survey would be the first step in evaluating the effect of mill processes on wool quality, a project that has been repeatedly requested by the industry. . . . I hope the woolen industry will recognize the value of the results and support the effort of the Institute."

A. G. Ashcroft, product engineer, Alexander Smith & Sons Carpet Co.—"Most of us are concerned with the question of the translation of ideas into action and that is the reason for this group meeting here and the reason for the existence of Textile Research Institute. . . . But with the exception of Harris' work in Wool and the Textile Drying Research project, we have not had many benefits from textile research and there has not been progress—although at the same time there has been a rapid growth in the competition of fibers, so you may see that this is the right time to take action. . . . There is value in financial cooperation in broad research of this type. Proper organization for this broader research is incorporated in the plan for the study of the wool processing problems."

Werner von Bergen, director of research, Forstmann Woolen Company—"Manufacturers of war fabrics have been under pressure to meet army inspection. . . . Group effort carried out under the American Association of Textile Chemists and Colorists proved of immense value in reducing dyeing costs particularly through elimination of rejected merchandise. The outlined wool program will constitute another valuable contribution to the solution of many problems of the manufacture of war fabrics."

Some Results of Recent Research Are Disclosed at Symposium on Functional

Properties of Clothing Fabrics

A symposium on the functional properties of clothing fabrics was held at the afternoon session of the annual meeting of Textile Research Institute, Inc. The symposium was under the chairmanship of Dr. Milton Harris and the following is a brief review. A complete report of the addresses in which the speakers outlined the problems involved and the test methods devised for evaluating the properties of clothing fabrics—properties upon which we depend for comfort and protection, is being mailed to members of the Institute. Non members may obtain same at 50 cents per copy by writing Textile Research Institute, Inc., 10 East 40 St., New York 16, N. Y.

Introductory Remarks by Dr. Harris

IT HAS BEEN ABLY EXPRESSED: military fabrics need to be infinitely strong, infinitely light, and infinitely warm or cool as necessity demands.

One thing became apparent early in our researches: namely, that we could not depend on the empirical and frequently unscientific information gained from long experience on civilian fabrics to tell us how a fabric or a finish would perform under the diverse and rigorous conditions met in military use.

Had the industry properly understood the fundamental principles governing the properties and behavior of fabrics, it would have met far more effectively the challenge of the situation we faced. Furthermore, it would not have been led down so many blind alleys.

A case in point: on the basis of the reasoning that fabrics required for jungle troops besides protecting the body must allow free passage of perspiration, the industry was asked to provide open-weave fabrics. In order

to make possible the free passage of water vapor it was found that other factors in jungle clothing are far more important than the size of the holes. Actually in subsequent tests one of the most tightly woven cloths tested proved to be one of the most satisfactory for this purpose. We are now finding it necessary to evaluate as we have never had to do before those properties of fibers and fabrics that make for better performance.

Every fabric poses a different problem: water-repellency in cloth is one problem, tentage a different problem. Practical considerations make the problem of warmth in clothing somewhat different than in blankets. With this in mind the discussions this afternoon will be centered about the fundamental principles involved in the utilization of textiles to keep the body warm, comfortable and dry.

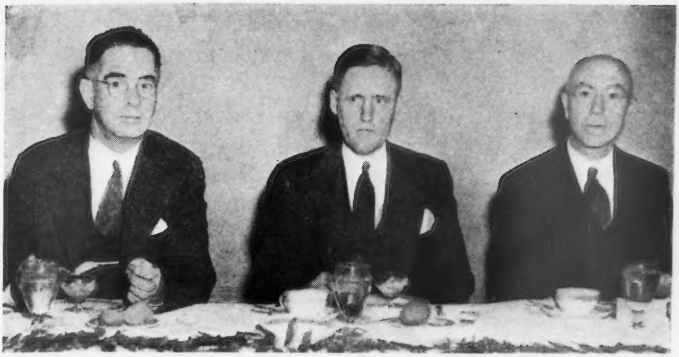
Factors Relating to the Thermal Insulating Values of Fabrics *

The problems which have arisen in connection with the present war, particularly in connection with flying at high altitudes, have given great concern to those responsible for procuring clothing which will provide adequate thermal insulation to the men of the armed forces.

Measurement of the thermal insulation of fabrics is dependent upon the principle that if the fabric to be tested is made a part of the medium between two bodies of different temperatures, heat will be transferred from the one of higher temperature to the one at lower temperature. The manner in which heat is transferred and the rate of transfer is a function of several factors, such as the temperature difference between the two bodies, their surface emissivity, and the nature of the medium separating them. The fabric will affect the rate of transfer through the medium. Not only is it extremely difficult in testing to confine the heat transfer to a definite area of the fabric, but the hot body itself loses heat in all directions unless adequate precautions are taken to eliminate all heat losses except through the desired area of the fabric.

The ordinary quantity formula for thermal trans-

* Abstract of address by Dr. Herbert F. Schiefer, physicist, National Bureau of Standards.



At speakers' table, Institute luncheon: left to right—Russell T. Fisher, president, National Association of Cotton Manufacturers; R. J. Cheatham, chief, Division of Cotton Processing, Southern Regional Laboratory; Wm. D. Appel, chief, Textile Section, National Bureau of Standards and chairman applied research committee, Textile Research Institute, Inc.

mission does not take into consideration the effect of moisture content of the specimen during the measurement and of the thickness of the fabric. Fortunately, many of the fabrics of which the thermal transmission values have been measured at the Bureau of Standards, have also been tested for other physical properties and it has been possible to deduce certain empirical relationships concerning the correlation between thermal transmission and other measurable properties. For example, formulas have been derived which express the relationship of thermal transmission to thickness.

None of the formulas discussed, however, give the thermal transmission value of a fabric when it is compressed under a given load. The necessary work to obtain these formulas has not been done.

The analysis of many thermal transmission measurements indicates that the kind of fiber has no effect on the thermal insulation of fabrics. As far as the measurable properties of blankets is concerned, the only property which is definitely related to the kind of fiber used is the compressional resilience. Since a definite relationship has been established between the thickness and thermal insulation of fabrics, a blanket containing all wool and having a high compressional resilience probably will re-

tain its original thickness more nearly than a cotton or rayon blanket. Date concerning this phase however, is rather meager.

With regard to the thermal insulation of fabrics I believe that there is a fertile field for further research. For example, the optimum density of fibrous materials to yield maximum insulation is between 2 and 3 lb/ft^3. The density of the large series of blankets which we studied ranged from 3 to 11 lb/ft^3 and averaged 5.6 lb/ft^3. Clearly there is room for improvement in blankets and probably more so as far as other fabrics are concerned.

In using different types of thermal transmission instruments the experimenter should measure other properties of the fabrics and establish their relationships to thermal transmission which would make it possible more readily to translate the results obtained from one instrument to another instrument. If that had been done years ago, then the wealth of information published in the literature could be interpreted on a common basis.

Water Vapor Permeability of Fabrics *

Aside from the general principle that we prefer lighter clothing in the summertime, we are faced with the problem of discriminating between particular fabrics. That has led to a program of attempting to measure water vapor permeability.

There is an insensible perspiration which goes on all the time whether we are warm or cool. This value ranges from a minimum of about 20 grams of water per square meter per hour to a maximum sweat production of 1000 grams or even higher. But the amount which can be evaporated and the amount which does useful cooling is frequently very much less, and there is where the effect of textile fabrics on keeping cool comes in.

Evaporation would be much more rapid were it not for the resistance of a layer of relatively still air that is known to lie next to the surface of any object in air.

A rather surprising result of tests is that water vapor permeability is largely independent of the porosity of the fabric and that the main resistance to the passage

* Abstract of address by Dr. Lyman Fourt, Textile Foundation.

of water vapor is in the layer of air inside the clothing and outside the clothing. The resistance of the cloth has been found to be contributing not over five to ten percent of the total resistance to the passage of water vapor, and therefore we can select perhaps the most tightly woven of all the cloths available if it is more suitable on other grounds.

For example, in comparing the suitability of specific cotton fabrics for jungle use which varied in thickness through a comparatively small range but varied in air permeability through a somewhat larger range, it was found that the intrinsic resistance to the passage of water vapor was hardly different for the fabrics tested.

I think that much more work is needed in correlating this with our physiological observations. The human body is really extremely sensitive, compared with most laboratory instruments, to change in temperature; and in the summertime even a very small heat load imposed by thermal insulation of the fabrics is reflected in the necessity for increased sweat production and the necessity for increased evaporation. Thus we have an amplification effect which makes us very sensitive to differences in resistance in summer clothing.

The Problem of Water-Repellent Fabrics *

The water-repellency problem is not merely one of keeping dry, but rather one of keeping both dry and comfortable and the problem of ventilation must be considered in any clothing study.

The problem for the textile industry to solve seems to be that of designing suitable fabrics and garments on which to put water-repellent finishes of which there are a number of good ones available.

In addition to the usual tests we have used a rather simple rainfall apparatus the action of which we have found correlates closely with that of actual rainfall, and includes the important factor of the impact action of falling drops of water. We have found also that it is important to subject the fabrics to a use test before applying tests for water repellency. *(Continued on page 26)*

* Abstract of Address by Arnold M. Sookne, Textile Foundation.

In testing numerous types of water-repellent fabrics, using different finishes and materials we have observed a number of possibilities for fabrication: In the first place there is a connection between the resilience of the fabric or of the material underneath the fabric and the resistance to rainfall. For example a water-repellent poplin stretched over a piece of glass will permit the first drop of water to penetrate the poplin and strike the glass. On the other hand with a resilient material beneath the poplin, it will withstand a long continued wetting.

Doubling the fabric also yields a rather dramatic increase in resistance to penetration. Which suggests that the air layer between the two fabrics provides a somewhat better resiliency. In addition the results suggest the importance of the continuity of holes through a fabric since the chances for a juxtaposition of holes in the two fabrics is slight. Because of the fact that a double fabric may not be practical one should look for a single fabric so constructed as to provide adequate protection. In this the English have done a considerable amount of work with materials of different weaves.

Again we have discovered that the air permeability is not always a reliable indication of the holes that let the water through. Too much emphasis seems to have been put on a porous weave to allow perspiration to evaporate. It appears from measurements made recently that the tightest fabrics will still allow enough moisture to pass through to allow adequate ventilation. The British at the Shirley Institute have produced a very successful cloth which is constructed with a very tight oxford weave with yarns that are softly twisted. After weaving the cloth is generally mercerized so that the additional swelling tends to fill the few remaining holes in the fabric. Furthermore when this fabric becomes wet, the swelling of the fibers acts to close up the few remaining openings so that it becomes more effective wet than when it is dry.

The conclusions to be drawn from these observations are that the fabric construction and the way it is put into the garment play at least as important a role in water-repellent clothing as does the finish.

Milton Harris Joins the Staff of Textile Research Institute as

Director of Fundamental Research

Dr. Milton Harris has accepted appointment as director of fundamental research of the Textile Research Institute, Inc. He will continue as director of research of the Textile Foundation, whose laboratories are located at the National Bureau of Standards, Washington, D. C.

Dr. Harris graduated from Oregon State University in 1926, and in 1929 received Ph.D degree in chemistry at Yale University. After a year in the fur and leather industry and two years as a research chemist with Cheney Brothers, he became research associate for the American Association of Textile Chemists & Colorists at the National Bureau of Standards in Washington. In 1938 he was appointed director of research for the Textile Foundation and since that time has had charge of the Foundation laboratories and staff at the Bureau. Since the United States entered the war, Dr. Harris has actively engaged in important work for the Armed Services and the National Research Council.

Milton Harris, director of applied research for Textile Research Institute, Inc., and director of research for the Textile Foundation.

Fact-Finding Is the Only Springboard for

A Better Day

By DOUGLAS G. WOOLF

"We have lived and we are living in a rotten world. . . . Only by handling the old structure roughly, only by conquering our inertia, only by daring to venture on new ways, can we hope to see a better day."

In those few words, Sumner Welles has summed up the case for those of us who believe that nothing that has gone before can be accepted as a guide for the future.

It *is* a rotten world today—not because any one group or class has made it so, but because all groups and classes have gone their divergent ways, with pandemonium as the net result.

The old structure *must* be handled roughly, not because it was rotten by pre-conceived plan, but because it was rotten by lack of plan.

Inertia *must* be conquered, not because inertia has been a tool of any one group, but because inertia is always man's worst enemy.

New ways *must* be ventured, not because new ways of themselves are assuredly better than old ways, but because a failure to try new ways is the beginning of the end for any group or class which so fails.

Possibly nowhere in our national economy are Sumner Welles' remarks more pertinent than in the field of textile research. In no major zone of our national life has inertia been more prominent, nor the daring to venture on new ways more rare.

There, again, the fault has been no positive one of any group. It has been a negative fault: the absence of cen-

tralized effort.

That is what cooperative research can supply to a decentralized industry.

Dr. Hugh S. Taylor, principal speaker at the luncheon of the annual meeting of the Textile Research Institute, expressed that viewpoint perfectly. For the decentralized industries operating in small, widely scattered units not capable of maintaining fundamental research laboratories, he stated, the solution of their problem lies in cooperative effort through the development of a research institute whose main objectives should be, first, the prosecution of fundamental studies; second, the dissemination of research information; and, third, the training of specially selected personnel in the methods of research, at the graduate student level, for future positions of responsibility within the industry.

That is the program of the Textile Research Institute.

Those of us who heard Dr. Taylor speak were privileged to watch in action the mind of a man to whom research is romance. It was a very rare experience. Those to whom research may still be an abstraction got a realistic picture of research, not as a tool of the scientists, but as the most important tool of an industry engaged in the business of making a living, and building an assured future, for itself and its employees.

Never before in the history of the textile industry has the issue been more sharply drawn than at present. There is a clean-cut choice between adherence to status quo and adjustment to an uncharted post-war world. The former path will lead surely to depression, and probably to extinction; the latter path to survival and progress. Fact-finding is the key.

This is no dream. It is reality. It is the only way out.

Sumner Welles is correct in his diagnosis; Hugh Taylor is correct in his prescription.

To handle the old structure roughly, it is important first to develop facts. And then those who use such facts will not be handled roughly; they will venture on new ways, and will live to see a better day.

Will Post-War Organization of Textile Companies Be

Vertical or Horizontal?

By H. S. DAVIS*

In discussing current cases of vertical organization the following article builds on a comprehensive study of the subject which was sponsored by the Institute and the Textile Foundation in the late '30's. The report of this study, titled "Vertical Integration in the Textile Industries," was prepared by the Industrial Research Department, Wharton School, University of Pennsylvania from whom copies may be obtained at a special price of $1.00 per copy—address, 3440 Walnut Street, Philadelphia, 4, Pennsylvania. They may also be obtained from the Textile Foundation, 10 East 40th St., New York 16, N. Y.

NOW IS A GOOD TIME for textile companies to revamp themselves for peace-time business. At least that is the opinion of some executives as evidenced by recent reports of several mills changing ownership, others changing their selling arrangements, and even a few others setting up new plants. Prominent in these reported actions because of their departure from the usual pattern are the new undertakings of the Atlantic Rayon Corp. and S. Robert Stone, Inc. Both are cases of vertical expansion.

The Atlantic Rayon Corp., a rayon yarn-processing company, is expanding market-wise by acquiring Suncook Mills, a rayon-weaving plant, and by forming a new subsidiary, Textron, Inc., to manufacture and market women's slips and other consumer products of rayon. In contrast, S. Robert Stone, Inc., converters of curtain goods, are expanding supply-wise by acquiring Fisher

* Industrial Research Department, Wharton School of Finance and Commerce, University of Pennsylvania.

Manufacturing Co., weavers of fine cottons including curtain materials.

Any textile company which is considering vertical expansion either for the purpose of getting closer to the consumer market, or for securing more control over its supply of materials can learn much from the manner in which the Atlantic and Stone organizations are being set up. In both cases well-tried principles of vertical organization are being followed with interesting variations.

Getting Closer to the Consumer

Getting closer to the consumer market is the program of the Atlantic Rayon Corp. Starting as a converter and a commercial dyer of rayon yarns, this company has acquired Suncook Mills, a producer of rayon gray goods, and has formed a subsidiary known as Textron, Inc., to market women's slips made in the cutting rooms of a plant originally set up for the manufacture of parachutes. In addition to slips, Textron is also selling shower curtains, drapes, and piece goods to retail stores, and it is understood that other merchandise will probably be added to the Textron line.

On the basis of the information now available about the Atlantic program, it could well prove to be a highly successful one. It is to be noted that its first apparel product is to be one in which style and variety play an unimportant role as compared with quality and wearability. It is true that the elements of style and variety are bound to enter into almost every item of a woman's wardrobe, but in selecting slips Atlantic has chosen the merchandise with the combined features of least style and greatest volume in the whole field of women's apparel.

As textile men will recognize, the Atlantic Corporation is making use of one of the most thoroughly tested principles of vertical organization when it adds a consumer-goods department which does not have to be supplied with fabrics of great variety in color, pattern, or construction. This same principle can be used to explain the widespread success of textile mills in the sheet business and their infrequent success in the apparel field. Readers who want an analysis of how both mills and cutters have tried to meet the variety problem in com-

bining cloth and garment manufacture are referred to "Vertical Integration in the Textile Industries."

Of course in undertaking to sell shower curtains, drapes, and yard goods to the retail trade, Atlantic will not be protected against the problems of variety as they are in the slip business. There is, no doubt, a fair demand for staple colors and patterns in shower curtains, drapes, and yard goods, but effective merchandising will probably require handling both staple and style lines. It is worth pointing out, however, that the style element involved is entirely within the fabric itself; in selling shower curtains and drapes to the retail trade, Textron assumes no more style risk than if they stopped with the converting operation, and perhaps not as much, since dealing with the retail trade offers opportunity for keeping informed about consumer reaction, and in some cases for bigger accounts than at prior levels of operation.

Partial vs. Complete Integration

While Atlantic's executives are making use of one of the major principles of successful market-wise integration in beginning with consumer products in which variety is unimportant or is restricted to the fabric itself, they appear to be on the road to flouting another. In many cases of successful forward integration whether from yarn to gray goods, gray goods to finished goods, or finished goods to consumer product, the initial step has been to develop a new market for the vertical undertaking which used only a part of the company's output and which did not compete with its original product.

Were Atlantic Rayon following past practice it might, for example, continue to operate Suncook Mills primarily as a producer of gray goods for sale to converters of dress goods, and finish only a small portion of the output for manufacture into slips for sale by its subsidiary Textron. Perhaps this policy of selling noncompeting gray goods and finished consumer merchandise may be followed, but the variety of consumer products of rayon which are already in the Textron line and the promotion campaign now evidenced by national advertising suggest that Atlantic is going to defy convention and develop a vertical organization designed to market all or a substantial part of its cloth output as con-

sumer goods direct to retailers.

Ordinarily the business of developing a full-blown vertical organization which extends from gray goods manufacture to direct distribution of consumer textiles to retailers is looked upon as fraught with great risk, at least in the initial stages. Developing a new market is expensive and may not result in great volume for a considerable time. Meanwhile old customers are likely to be increasingly difficult to sell as they see their source of supply going into their business or that of their customers. As a consequence, an integrating mill may kill its old market before it has developed a new one.

Unusual circumstances minimize marketing risks in the case of Atlantic: customers have to be solicited for Suncook's product anyway since the mill is a recent acquisition, and so Atlantic executives will not have the fear of losing customers that they would have had as executives of some years' standing at Suncook; war contracts now provide a good back log for Suncook and Atlantic's cutting department and may for sometime in the future, thus bridging the gap between productive capacity and sales volume which might otherwise have existed; furthermore, the whole textile trade from converters to retailers are so hungry for goods that supply from any source will be welcomed.

Despite the favor of circumstances, the Atlantic venture is a highly risky undertaking viewed against the recent history of the textile business. It has been one of the amazing features of recent decades that a clever buyer of piece goods could almost always get goods cheaper than they could be made by an integrated organization—even the most efficient. Those who cite this condition, either as a reason for not thinking about post-war organization for their own company or in raising skepticism about Atlantic's endeavor, should not bank too much on the 40's and 50's repeating exactly the experience of the 20's and 30's.

Price movements in textile merchandise in the 20's and 30's were largely ruled by raw cotton and raw wool markets. This can hardly be true of the decades ahead, considering that the use of man-made fibers now exceeds that of wool and threatens to displace cotton for many

products. The prices of natural fibers may still fluctuate and may even undergo wider movements than those experienced during the last twenty years, but they can hardly continue to dominate textile buying. It is likely that the coming of age of the man-made fiber industry—for, broadly speaking, that is what the war has done for rayon—can well be the beginning of a new era of price stability in textiles, and in that event forward integration of the type undertaken by Atlantic Rayon may be much more commonplace in the years ahead.

Insuring Supply

Reference was made earlier to the acquisition of a cotton mill by a converter of curtain fabrics. This purchase is another example of integration, but supply-wise rather than toward the market. According to press reports, the converting house will use this cotton mill to manufacture goods for its own account, and press statements are further authority for the report that the house, S. Robert Stone, Inc., uses three or four times as much yardage as the mill which it has acquired is able to produce. If these reports are true, Stone, Inc., has adopted the most effective form of backward integration. Under the reported set-up, the capacity of its fabric-producing department will be tapered with reference to that of its curtain fabrication.

The tapered relationship between fabric production and fabric use is one that has been proved over and over again when users of textile fabrics have become mill owners. By this method of operation, the integrating company is virtually assured that it will never have an idle mill on its hands in times of slow business. So long as its capacity to produce cloth is much less than that of its fabricating capacity, it can curtail operations at the expense of its other sources of supply, not at the cost of overhead on its own idle plant.

Companies setting up the backward-taper type of organization should not forget that its success depends very directly on the existence of an ample market in which to buy needs in excess of their own production. The rubber-tire companies employed exactly this same device when they first went into the manufacture of cotton yarn. The experience of these companies shows that a group of tex-

tile users can integrate backward into the production of materials formerly purchased to the point where they begin to dry up the market on which they depend to take up the slack when their own requirements are running heavy with the result that they have to go completely into the textile business and become sellers as well as users.*

Another danger of backward integration is also evident in the rubber company experience, and that is being brought home today by the development of rayon tire cord. Probably most of the tire companies with cotton-yarn plants will be able to make some adaptation of their equipment to prepare rayon for tire cord purposes, but integration has not saved them from this problem. It has forced it upon them. In other words, any company which tries to manufacture the product which it is buying must always take into account that new techniques may outmode the material or the process involved. A company which integrates backward without taking this factor into account and without making provision for keeping its materials and process up-to-date may be risking serious financial losses, if not financial ruin.

New Conditions May Require New Organization

There can be little doubt that the years after the war are going to see many changes occurring in the business of producing and marketing textiles. New materials are certain to be available, and it would be short-sighted not to count on new processes also. The plastics industries are likely in many fields to give new competition, and new modes of living will probably bring demands for new kinds of fabrics and garments. It could well be, too, that American textiles, particularly American-styled garments, would gain world-wide attention in the age of air transportation for which the war is equipping the United States to play a leading role. No company can be sure that the organization which served it well during the 20's and 30's is thereby automatically the best organization for the 40's and 50's. No mill management could justify such confidence until it has reviewed its present organization in terms of the conditions which it is likely to face in supplying peacetime markets.

* A more complete story of the rubber company experience, as well as, of other ventures in combining the production and use of industrial textiles, is given in "Vertical Integration in the Textile Industries."

RESEARCH ACTIVITIES

The semi-annual conference of textile school deans, attended by deans of the eleven textile schools, three members of the Textile Foundation, and other men prominent in the field of textile education, was held October 29, 30 and 31, in New Orleans, La. The training of service men honorably discharged was approved by members of the Foundation and several deans reported contacting the Veterans Bureau for this purpose. Deans of 4 of the textile schools—the A. French Textile School; Clemson College; N. C. State; and the Philadelphia Textile Institute—reported a total of approximately three million dollars raised for increasing educational facilities in their schools, with an additional two million expected.

Roland E. Lee, of the Southern Regional Research Laboratory at New Orleans, has been selected as cotton technologist and dean of educational activities at Callaway Institute, Inc.

Announcement has been made of the appointment of Jesse W. Stribling as editor of *Cotton*, effective January 1st. He succeeds Robert W. Philip who has accepted the position of president and executive director of Callaway Institute. Since 1925 Mr. Stribling has been field engineer of the Universal Winding Co., Providence, R. I., with headquarters in Atlanta. He is a graduate of Clemson College, 1916.

W. D. Appel, chief of the textile section of the National Bureau of Standards, has been elected president of the American Association of Textile Chemists & Colorists, succeeding Thomas R. Smith of Wiscassett Mills Co., Albemarle, N. C. Mr. Appel is chairman of the committee on applied research of the Textile Research Institute, Inc.

ABSTRACTS

Members of Textile Research Institute, Inc., desiring complete copies of articles abstracted may obtain photostat copies at cost by addressing the Institute's office, 10 East 40 St., New York 16, N. Y. The price of a photostat negative is seldom more than 50 cents per page of original text.

Translations of articles appearing in foreign language publications and abstracted in TEXTILE RESEARCH, *will be furnished at cost when the original publication is obtainable.*

ANALYSIS: TESTING LABORATORY METHODS

Testing Fabric Smoothness

A friction meter for determining the coefficient of kinetic friction of fabrics. Edwin C. Dreby. *J. Research Natl. Bur. Standards*, **31**, 237–46 (Oct. 1943).

A friction meter is described, and its application to the evaluation of the smoothness of a wide variety of fabrics is discussed. The ruggedness, sensitivity, and ease of operation of the instrument make it suitable for the routine testing of fabrics, the evaluation of finishing agents, and the control of finishing processes.

American Society for Testing Materials

The relation of the American Society for Testing Materials to the textile industry. Herbert J. Ball. *Am. Dyestuff Reptr.* **38**, 419–22, 428 (Sept. 27, 1943).

The organization and general summary of the activities of Committee D-13 are described.

pH of Textile Materials

Determination of the pH of textile materials. H. R. Wakeham and E. L. Skau. *Ind. and Eng. Chem., Anal. Ed.* **15**, 616–18 (Oct. 1942).

At present, the pH of textile materials is considered as the pH of a water extract of the material. The amount of water used has not been considered critical. Two gram samples of cloth were extracted with 3, 4, 5, 7, 10, 15, 20, 30, 50 and 100 ml of water and the pH of each extract determined. Results were plotted and the curve extrapolated to give a pH value for the water actually in the fiber. In most cases, the pH value thus obtained was further from the neutral point than that obtained by the usual method. It is suggested that this method be used to determine the pH of textile materials and that the pH of a textile sample be defined as the pH of the water in the sample under standard conditions.

CHEMICAL AND PHYSICAL RESEARCH

Color

Historical background and evolution of the colorimetry report. L. A. Jones, Chairman, O. S. A. colorimetry committee.

Concept of color (Chapter II of colorimetry report). *Jour. Opt. Soc. Am.* **33**, 534–54 (Oct. 1943).

The colorimetry committee of the Optical Society of America expects to publish its final report in book form, amply illustrated and well supplied with color plates. Meanwhile, owing to conditions which prevent immediate publication, portions of

the report are being published in the journal of the O. S. A. Publication of this report is outstanding news to anyone in color for into its preparation have gone years of cooperative effort by the leading color scientists and technologists in this country.

Some factors and implications of color constancy. Harry Helson. *Jour. Opt. Soc. Am.* **33**, 555–67 (Oct. 1943).

Dr. Helson is a leading authority among psychologists in this country on the subject of color constancy, and in this paper he was invited to review the subject for the Optical Society. Textile people interested in basic color problems will find this paper useful. It discusses conditions and modes of color; tolerance to changes in illumination; relation of contrast, constancy, adaptation, and other visual processes; effects of neighboring colors; etc.

Color Blindness Tests

Farnsworth-Munsell 100-hue and dichotomous tests for color vision. Dean Farnsworth. *Jour. Opt. Soc. Am.* **33**, 568–78 (Oct. 1943).

Single judgment test for red-green discrimination. Le Grand H. Hardy. *Jour. Opt. Soc. Am.* **33**, 512–14 (Sept. 1943).

These two papers describe three recently developed tests for color vision that cannot be memorized. Lt. Farnsworth describes two tests making use of Munsell papers, one an exploratory test for laboratory examination of color vision using 100 Munsell hues, the other a short screening test which places subjects in two classes of color anomaly. The test described by Dr. Hardy is one which members of the Inter-Society Color Council have cooperatively developed. It makes use of materials developed for a color aptitude test, and puts them into a test for red-green discrimination. The test is made of durable and permanent materials to exact colorimetric specifications; it is simple and rugged, fairly convenient in size, portable; it can be made self-administering; it includes its own standard daylight; and on the basis of 40 judgments subjects can be divided into three groups.

Cellulose, Amorphorus and Crystalline

Kinetics of oxidation of cellulose with periodic acid. G. Goldfinger, H. Mark and S. Siggia. *Ind. and Eng. Chem.* **35**, 1083–86 (Oct. 1943).

X-ray studies have indicated that cellulose consists of an amorphous and a crystalline portion but do not give satisfactory quantitative results. The oxidation of the hydroxyl groups on positions 2 and 3 to the aldehyde and then the carboxyl group by the periodate ion provides a method for a quantitative determination of the two fractions of cellulose. The penetration of the periodate ion is more rapid in the amorphous than in the crystalline portion. Graphs and equations are used to calculate results. Purified cotton linters contains 6% amorphous, cellulose regenerated from cuprammonium solutions 7.4 to 19.5%, commercial cottons 1.0–2.1%.

DYEING: BLEACHING: FINISHING

Flameproofing Damage

Deterioration of flameproofed cotton fabric. A. S. Tweedie and C. H. Bayley. *Am. Dyestuff Reptr.* **32**, 427–28 (Sept. 27, 1943).

An investigation has been carried out to determine the comparative deterioration, in terms of tensile strength loss and cuprammonium fluidity rise, produced in cotton fabrics by the use of certain common

soluble flameproofing substances. The tensile strength and fluidity measurements were made after five and ten treatments with the flameproofing solution, the impregnant being removed by rinsing between each treatment. All methods tested showed measurable loss in strength after ten treatments and corresponding fluidity increase showed that chemical damage had taken place. Of the impregnants tested, borax-boric acid mixture was the least harmful to fabric, while ammonium sulfate and ammonium sulfamate caused the greatest deterioration.

Uses of Glycerine

Glycerine in newer dyeing and finishing processes. G. Leffingwell and M. Lesser. *Textile Colorist* 65, 398–401 (Sept. 1943).

The hygroscopicity, dispersing and solvent qualities of glycerine are responsible for its use in a number of textile processing formulas. Several patents and processes in which glycerine is employed are described. Glycerine finds wartime use in textiles as an ingredient of special finishes rendering fabrics resistant to poison gases. The alkyd (or glyceryl-phthalate) resins either used alone or to modify other types of resins are finding increased use in textile printing and finishing, and another recently developed textile finishing material consists of a solvent solution of ester gum, which is a glycerine ester of a natural resin.

Vinyl Resins

Vinyl resins—their uses in textile finishing. Leonard S. Shapiro. *Cotton* 107, 84–85 (July 1943); *Ibid.* 107, 68–71 (Aug. 1943); *Ibid.* 107, 89–92 (Sept. 1943).

Polyvinyl Chloride is very resistant to chemical attack, and is soluble only in a few higher ketones and chlorinated solvents. When properly plasticized, it may be calendered or spread-coated on fabrics. Its chief uses are in flameproof wire coatings, and flameproof coated fabrics.

Polyvinyl Acetate is a soft resin tacky when warm. Solutions or emulsions are used for adhesives for a wide range of surfaces, and for laminating fabrics. It is exceptionally tough, clear, and glossy and unaffected by light.

Vinyl Chloride-Acetate Copolymers contain 85% or more of vinyl chloride and retain many of the better qualities of both the chloride and acetate polymers. Because of their greater solubility in readily available solvents, they are widely used for coating military fabrics, such as rain-coating, hospital sheeting, paulins, and flameproof fabrics. Coating formulas and methods are discussed.

Highly polymerized copolymers are used for the synthetic fiber "Vinyon" which is now used chiefly for industrial fabrics, insulation, nautical twines, fishlines, and awnings.

Polyvinyl Alcohol is water-soluble and is used as an adhesive, binder or coating medium and as an emulsifying and dispersing agent. Uses for paper-coating and methods of improving water resistance are discussed. Polyvinyl alcohol is also used for oil-resistant and gasoline-resistant tubing.

Polyvinyl Acetals are formed by treating polyvinyl alcohol with aldehydes. Most important is *polyvinyl butyral*, the most successful laminating medium for safety-glass. The butyral is thermoplastic and has a low softening point, but it may be made *thermosetting* by the addition of compounds which form cross-linkages.

Thermosetting Polyvinyl Butyral is used for coated fabrics for rain-coating, water bags, hospital sheeting and mustard-gas resistant cloth.

Coating procedures for these fabrics are discussed.

Vinylidine Chloride Polymers and Copolymers are the newest members of the vinyl family and are made in all degrees of hardness or plasticity. Principal uses at present are for chemically-resistant pipes and tubing, acid resistant laboratory or industrial equipment, etc. Filaments are used for window-screening, upholstery, and fishing lines.

FIBERS: YARNS: FABRICS: MECHANICAL PROCESSES

Properties of Nylon

Physical-chemical properties and processing of nylon textiles. Special Bulletin, E. I. du Pont de Nemours & Co. 63 pp. (1943).

The important physical and chemical properties and characteristics of nylon are described in detail including its resistance to such causes of damage to textiles as attack by insects, molds, marine deterioration, chemicals, light, and abrasion. Test methods are suggested. About half of the book is devoted to methods of processing nylon. Some of the subjects discussed are: tension devices, sizing, control of static electricity, warping, weaving, scouring, bleaching, dyeing, and finishing. The bulletin is prepared primarily for the benefit of throwsters, weavers, and finishers of nylon fabrics, but the fundamental yarn data applies equally to other trades.

Parachute Fabrics

Parachutes and the new fabrics they require. Anon. *Textile World* **93**, 65–68 (Oct. 1943).

This article is intended to present an over-all picture of the many different types of parachute fabrics currently being procured. Sufficient information is given on fabric constructions to permit textile manufacturers to determine which of these fabrics they are in a position to produce. More complete data are contained in the specifications, and copies of these should be secured before making up samples.

Power Requirements

Power requirements for spinning. (A reproduction in part of a report by the late E. A. Untersee of General Electric Co.). *Textile World* **93**, 98–99 (Sept. 1943).

A report of tests to determine the characteristics and power requirements of spinning frames. Tests were made on a Whitin 348 spindle frame with 1½–2–2¼ in. rings, operating at different speeds, and on a 216 spindle Whitin frame with 2¼–2½–2¾- and 3-in. rings spinning 10s yarn. Formulas and tables are furnished to aid in the selection of proper size of motor for driving frames. For example Table I lists the spindles per horsepower for different sizes of yarns at various speeds. Relation between yarn size and weight is shown.

High-Temperature Heating

High-temperature heating with hot water for post-war in dye houses offers savings in fuel and installation. Paul L. Geiringer. *Textile World* **93**, 100–01 (Sept. 1943).

High-temperature hot water heating has been used successfully and resulted in large savings in textile mills in Great Britain, Germany, Czechoslovakia, Austria and other European countries. The allocation of heat by means of high-temperature hot water evades most of the deficiencies of low pressure and high pressure steam systems and results in higher overall operating efficiencies. An outline is given of the operation of this system and some applications described.

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of
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Textile Research Institute, Inc.

10 East 40th Street
New York 16, N. Y.
Telephone: Lexington 2-2196

Washington Office
Industrial Building
National Bureau of Standards
Telephone: Woodley 5088

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